

Original Research Article

The measurement of blood pressure in winter season and its co-relation with blood pressure after cold exposure in summer season: a cross-sectional study in Gauhati medical college and hospital, Guwahati, Assam, India

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ABSTRACT

Background: The aim of the study was to correlate the change in blood pressure in winter season to that in summer season after exposure to localized cold stimuli.

Methods: Basal blood pressure in healthy males of 20-40 years was recorded during winter season by conventional method using sphygmomanometer and stethoscope. During summer, the same subjects were taken and their baseline blood pressure was recorded. Thereafter their feet were immersed in cold water at 12 degree centigrade and blood pressure was recorded at 5 minutes and 10 minutes interval. The systolic and diastolic BP during winter, summer (baseline), and after 5 minutes and 10 minutes of cold exposure was compared. P value <0.001 as obtained by using student t test (student graph pad) was taken as significant

Results: It was observed that systolic and diastolic BP showed a significant increase ($p < 0.001$) in response to the cold stimuli. The increase was comparable to the rise in BP during winter.

Conclusions: Present study has revealed a higher systolic and diastolic BP in winter and in summer after cold stimuli than baseline summer BP; So we conclude that subjects with borderline hypertension who are more likely to develop higher BP in winter season are also likely to develop high BP after cold stimuli in summer season.

Keywords: Localized cold stimuli, Males, 20-40 years, Sphygmomanometer, Stethoscope

INTRODUCTION

Blood pressure generally is higher in winter and lower in summer because low temperature cause vasoconstriction causing increases in blood pressure. This variation is likely to affect the prevalence of hypertension in different seasons because of the fact that increase in blood pressure in winter will shift the proportion of the subjects from normotensive to the hypertensive category.¹

It has been shown in several studies that immersion of whole body or peripheries, example feet immersion in cold water during summer also causes rise in blood

pressure due to peripheral vasoconstriction.²⁻⁴ In a study in 1982, effects of cold exposure on blood pressure, heart rate and forearm blood flow in normotensives during selective and non-selective beta adrenoreceptor blockade, it was found that cold induces a sharp rise in blood pressure and heart rate which are more marked in the first few minutes.^{5,6} The present study aimed at stimulating the average minimum winter temperature at Guwahati i.e. approximately 12 degree centigrade and exposing the subjects to localized cold stimuli by feet immersion in cold water at 12 degree for 5 minutes and 10 minutes during summer and observing the change in blood pressure.

This study can help us to conclude whether cold exposure can increase blood pressure in summer season also, just as it does in winter season, thereby increasing the risk of cardiovascular diseases. Susceptible individuals can therefore take adequate precaution.

METHODS

The study was conducted in the Department of Physiology, GMCH, Guwahati, Assam, India for a duration of 6 months. Clearance was obtained from the Institutional Ethics Committee. The study was carried out on 50 healthy male staff of GMCH in 20-40 years age group selected by simple random sampling. Subjects with history of hypertension, cardiovascular disorders, diabetes mellitus, thyroid or other endocrine abnormalities were excluded from the study. An informed consent was taken from each subject before their participation. Materials required were thermometer, sphygmomanometer, stethoscope and cold water at 12 degrees centigrade.

The subjects were made to sit comfortably and their blood pressure was recorded during winter season (in the month of December) by conventional method using sphygmomanometer and stethoscope.

During summer (in the month of May), the same subjects were taken and their baseline blood pressure was

recorded. Thereafter their feet up to ankle were immersed in cold water at 12 degree centigrade and blood pressure was recorded at 5 minutes and 10 minutes interval.

Study was conducted between 9 am and 12 noon to rule out any alterations imposed by diurnal variation in BP.

The systolic and diastolic BP during winter and summer at baseline, and after 5 minutes and 10 minutes of cold exposure during summer was compared. P value was obtained after doing data analysis by using student t test.

P value <0.001 was taken as significant.

RESULTS

Mean Systolic BP in winter 119± 10 mm of Hg, in summer (baseline) 117±10 mm of Hg (Table 2) and (Figure 2), after 5 min cold exposure 121± 10 mm of Hg, and 119 ± 10 mm of Hg after 10 minutes cold exposure in summer (Table 1) and (Figure 1) were found. Mean Diastolic BP in winter 74±9 mm of Hg, in summer (baseline) 73±8 mm of Hg (Table 2) and (Figure 2), after 5 min of cold exposure 78±9 mm of Hg, after 10 min of cold exposure 76±8 mm of Hg (Table 1) and (Figure 1) were found. Values were compared by paired t- test revealing statistically significant (p<0.001) difference in both systolic and diastolic BP.

Table 1: Systolic and diastolic BP: Baseline and after 5 min and 10 min of cold exposure in summer.

Group	Baseline Mean±SD	Mean± SD (5 min)	Mean ±SD (10 min)	P value
Systolic BP (mmHg)	117±10	121±10	119±10	0.000
Diastolic BP (mmHg)	73±8	78±9	76±8	0.000

Table 2: Systolic BP and diastolic BP in summer (baseline) and winter.

Group	Baseline summer(Mean ±Sd)	Winter (Mean±Sd)	P value
Systolic BP (mmHg)	117±10	119±10	0.000
Diastolic BP (mmHg)	73±8	74±9	0.001

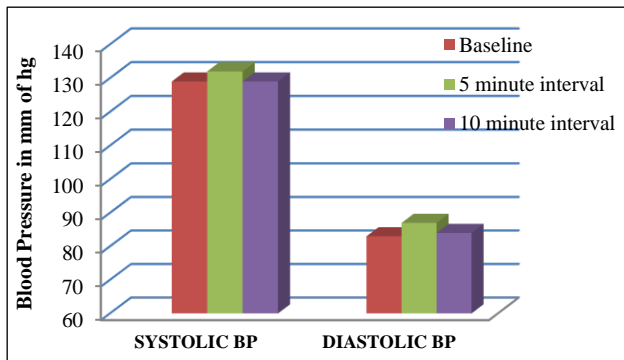


Figure 1: Systolic and diastolic BP: baseline and after cold exposure at 5 and 10 minutes interval in summer.

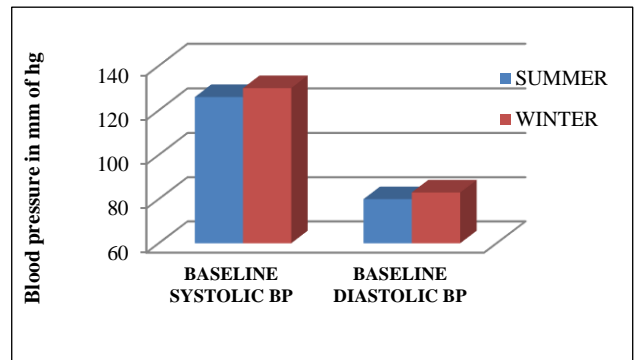


Figure 2: Systolic and diastolic BP in summer (baseline) and winter.

DISCUSSION

This study shows a significant rise in systolic and diastolic BP after cold exposure in summer which is comparable to rise in BP during winter season. It is similar to previous studies which showed that cold induced a sharp rise in BP and heart rate which are more marked in the first few minutes.^{7,8}

In this study, also significant rise in BP was seen after cold exposure in the first five minutes which came down towards baseline during the next five minutes. Moreover, in this study rise in diastolic BP was found to be more than rise in systolic BP. Exposure to cold elicits a generalized cutaneous vasoconstriction that is especially pronounced in hands and feet. If a peripheral limb is chilled, reflex generalized vasoconstriction is caused in part by the cooled blood that returns to the general circulation. This returned blood then stimulates the temperature regulating centre in the anterior hypothalamus which responds to direct application of cold to evoke cutaneous vasoconstriction. Moderate cooling or a brief exposure to severe cold (0-15 degree centigrade) constricts the resistance and capacitance vessels, including the AV anastomoses. Prolonged exposure to severe cold evokes a secondary vasodilator response.²

CONCLUSION

Blood pressure response to cold stimuli occupies an integral portion of the body defense mechanism. The deleterious effects of cold on blood pressure should be further evaluated to prevent them from causing any permanent damage to the body. Further studies and similar experiments with larger study groups and longer duration of study along with gender and ethnic comparison should be conducted to form a basis of the acute response to cold generated by the body to counteract it in all age, sex and religion.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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